OPTIMIZING DIAGNOSIS AND TREATMENT WITH ADVANCED ULTRASOUND IMAGING

Clinical experiences using new-generation ultrasound for better visualization and patient care

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THE ABSolu™ ULTRASOUND PLATFORM: AN INTRODUCTION

The ABSolu™ is a multi-functional ultrasound platform based on an all-in-one computer, with intuitive user interface that allows for quick management of all functions. It takes the user to the tasks they want to perform in an orderly manner.

Technological breakthroughs in the ABSolu™ include:

- A new 5-ring annular technology 20 MHz B probe that increases the depth of field by 70%, thus offering—in a single scan—high-definition information of the vitreous, retinal wall, and beyond.
- ABSolu™ also features a standardized A Mode that complies with all the hardware and software requirements necessary for proper tissue characterization essential for tumor diagnosis, as per the requirements of Prof. K. Ossoinig.
- Motion sensors (IMUv) have been integrated in all B Mode and UBM probes, allowing for an automatic and constant detection of the probe position and ultrasound beam direction to aid in education and training.
- A new signal processing for the linear 50 MHz UBM to offer high-quality images of the anterior chamber and lens.
- A 21" full-HD screen compliant with section 14 of the DICOM standard.

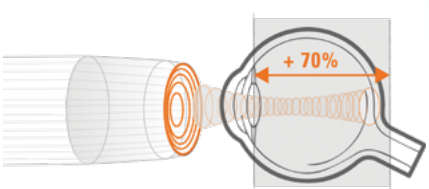
For ophthalmologists looking for excellence in ultrasound imaging, the ABSolu™ is the ideal partner in retina, oncology, private practice, and multispecialty practices.

ABSolu™ 20 MHz ANNULAR TECHNOLOGY

The new 20 MHz probe with annular 5-ring technology increases depth of field by 70% and lateral resolution. The set of concentric rings allows the ultrasound beam to be focused at different depths along an axis, and, therefore, widen the focal zone—unlike a 'classic' probe with a single transducer that is focused on a single plane: the retina.

The 20 MHz annular technology probe successively emits and receives the ultrasound waves and then synchronizes them. Acoustic resolutions are optimal in the focusing area, and users have the same lateral resolution on the majority of the globe (not just on a restricted area).

This technology makes it possible to specifically or simultaneously examine pathologies of the vitreous and retina—and beyond—without compromising on image quality, and sets a new standard for seeing more clearly, diagnosing more confidently, and enhancing patient management with improved sensitivity and resolution.



FACULTY:

YALE FISHER, MD

Dr. Fisher is a vitreoretinal surgeon with 50 years of experience in ultrasonography. He is a partner with the Vitreous Retina Macula Consultants of New York and a professor of ophthalmology at the Bascom Palmer Eye Institute at the University of Miami and Cornell Medical Center at New York Hospital. Dr. Fisher has lectured throughout the United States and abroad in the areas of ultrasonography and vitreoretinal surgery, developing new techniques and instruments in his field as well as pioneering developments in ocular endoscopy.

He has received no compensation or honoraria for his participation in this educational roundtable.

LUIS J. HADDOCK, MD

Dr. Haddock is a vitreoretinal and macular diseases surgeon at Bascom Palmer Eye Institute in Palm Beach Gardens, FL, and faculty at University of Miami Miller School of Medicine. He is also the Palm Beach medical retina fellowship program director. He has directed the ultrasound department at Bascom Palmer in Palm Beach and he is actively involved in resident and fellows education in retinal diseases and ultrasonography.

He has received an honorarium for his participation in this educational roundtable.

OPTIMIZING DIAGNOSIS AND TREATMENT WITH ADVANCED ULTRASOUND IMAGING

Clinical experiences using new-generation ultrasound for better visualization and patient care

The technology that supports ophthalmic imaging has advanced by leaps and bounds over the past few decades. Those advancements have provided ophthalmologists and retinal specialists with better ways to visualize, measure, diagnose, treat, and follow patients. Among the technology breaking new ground in terms of high-resolution imaging is the ABSolu™ ultrasound imaging platform.

Yale Fisher, MD, a vitreoretinal surgeon with 50 years of experience in ultrasonography, and Luis J. Haddock, MD, an experienced ultrasonographer and a vitreoretinal surgeon, discuss how this technology has helped them provide better patient care.

DR. FISHER: Diagnostic ultrasound started in the 1950s. A lot of interpretation was required in the 1960s. Every 10 years since, there's been some major improvement in instrumentation and image quality, which has brought us to where we are now.

Currently, the instruments that have been developed give amazing image quality and resolution for ultrasound that I've not seen before in an easy format. Dr. Haddock, what's been your experience in your time in ophthalmology? What are you doing with ultrasound now in your practice? What hardware are you using?

DR. HADDOCK: The technology has evolved significantly over the course of my short career, with the introduction of new probes that allow us to image the tissues with higher resolution, especially when imaging the structures of the posterior segment.

As a busy clinician and surgeon, the high-resolution scanning has improved my ability to create a 3D image of retinal pathology in order to diagnose pathology better, identify structures better, and guide my surgical approach.

The hardware that I am currently using is the ABSolu™ device, which I started using about 6 months ago when we moved to a new retina center at Bascom Palmer in Palm Beach. It's been one of the great additions to our state-of-the-art imaging center.

With the device, not only can I do the standard ultrasound using the B15 MHz probe, but we also have the annular probe, which is a B20 MHz high-resolution probe.

The annular technology allows me to image the posterior structures with very high resolution.

Having a device that highlights subtle anatomical pathology has been very helpful, as it has allowed me to scan the patient quickly and make sure I'm not missing any information that would be relevant for the diagnosis or management of the patient.

I also use it as an educational tool when I teach fellows and residents.

SOFTWARE AND HARDWARE ADVANCES = EFFICIENCY AND EASE OF USE

DR. FISHER: In your experience utilizing imaging devices—specifically ultrasound and B Mode diagnostic ultrasonography—do you begin with the B15 MHz probe, which is a single transducer, and then switch to the annular B20 MHz probe? Or do you go back and forth depending upon what you're finding?

DR. HADDOCK: I'm still learning, as we all are, about the applicability of the annular technology and which pathology is better imaged with this probe.

So far, I've been really impressed with the quality of the scans and the detail of the images even when scanning the retina or choroid. But because I'm more familiar with the images of the 15 MHz probe, I'm still going back and forth.

DR. FISHER: Do you have any use for the UBM 50 MHz linear probe for imaging the anterior segment in your practice?

DR. HADDOCK: I tend to use the UBM 50 MHz when a patient has corneal opacification, to look at the structures of the anterior segment. I also get a lot of second opinions for pathology secondary to IOL placement and/or exchanges.

It's very helpful to image the anterior segment in order to identify the anatomical relationship of the IOL to the iris root, and the ciliary body.

We will also use this probe in patients presenting with iris and/or ciliary body cysts, lesions, and malignancies (Figure 1).

DR. FISHER: And especially behind the iris and the pars plana?

DR. HADDOCK: Yes, behind the iris, the ciliary body, and the pars plana region. I think that area is imaged very well and can highlight anatomical changes that can change your clinical management.

DR. FISHER: How much time does it usually take you to do an ultrasound with this instrument? Do you find that there's any improvement in efficiency? Is there anything you can do with this that you couldn't do with previous machines or models?

DR. HADDOCK: The software is very intuitive; and it has really simplified the steps to acquire and save the images. The device also has a new automatic probe detector technology that increases efficiency by automatically detecting your probe position and the area of scanning. This has really sped up the scanning time because the motion sensor technology detects the location where I'm scanning and I don't have to manually select it. It identifies if I'm doing a transverse scan nasally or temporally, and displays a shaded scan area on a cartoon image of the globe on the screen in real-time and you can see where you're scanning.

It's also helpful when reviewing a scan completed by someone else, as the display of the shaded scanned area on the cartoon globe image allows me to better identify where the scan was taken. For instance, if you're doing a transverse of the nasal side, it will automatically detect it and mark it as a T3 for a left eye or a T9 for a right eye. Whenever the image is saved, this data is also saved.

IMAGE COURTESY: LUIS J. HADDOCK, MD

Figure 1. A 50 MHz (UBM) scan of iris lesion.

USING ULTRASOUND FOR INFECTION AND BIOPSY

"On occasion, patients will get infections, and I find that both the B15 and the B20 scans are useful in delineating the inflammatory changes inside the eye, especially in the vitreous cavity," says Dr. Fisher.

"Being able to delineate changes over several hours is very important in the case of an endophthalmitis, an infection caused by either a contamination or an inadvertent access by bacteria or other substances to inside of the eye. These devices are capable of picking up that inflammatory content and following it over the course of hours and demonstrating that it's getting worse."

When a physician recognizes an infection, one management technique employs taking a vitreous sample to culture it, Dr. Fisher says.

"To do that, you want to make sure you're taking a sample with a small needle in a place where you're most likely to get fluid and not over heavier materials, such as pus or fibrin," he says. "Having a good ultrasound using either of the instruments (B15 or the B20), or even using the UBM 50, really allows you to choose the area where you wish to biopsy, so you don't get something called a dry tap, where you try to extract something and nothing comes out."

Being able to tell where one should put the needle is an extremely helpful possibility with the ABSolu™ instruments, says Dr. Fisher, adding that he uses all three.

"I'll use the B15 to look at the back, then I'll use the B20 to look all the way around for evidence of choroidal detachment, and finally, I'll use the UBM 50 to decide where I'm most likely to get a pool of fluid in the anterior vitreous that I can extract without injuring other tissues that may be involved in the infection."

DR. FISHER: How long did it take you to get familiar or feel secure with the software?

DR. HADDOCK: I think it's very intuitive and simple, and can be easily customized. There could be a few more options you could potentially set. But the interface is pretty intuitive, relatively simple.

DR. FISHER: How about saving movies?

DR. HADDOCK: Whenever you save any image, it's actually being recorded as a short movie, which can also be easily saved. That's something you can add in the settings.

DR. FISHER: I found one thing that was very important is that you have to decide what you're going to save before you end the session. If you want to save as still, you have to save it by a long press on the foot pedal. If you want to save a movie, you have to outline how much of the segment of 5, 10, 15, or 20 seconds you wish, and then press save or hard press the foot pedal. It does remind you before you get off the session that you're going to lose everything that's temporarily saved and you're only going to save what you have pushed to "Save." It's nice to be able to download a movie segment on a USB if you need to give talks or lectures. Printing still images or direct transfer of saved scans to EMR is easily done.

DR. HADDOCK: Yes, the EMR connectivity has worked very well. You get the video, and the stills, sent right to the patient file.

CLINICAL BENEFITS OF HIGH-RESOLUTION ULTRASOUND

DR. FISHER: Regarding axial and lateral resolution, sometimes they're done on phantoms, but for the most part, they're done by mathematical calculations. Actually, the annular technology, which represents a probe with five annular transducers—as opposed to the B15 MHz probe, which has a single transducer—can give you a resolution in the range of 80 microns, and lateral resolution at around 200 microns. I find it to be somewhat better, and I judge that clinically.

What's been your experience?

DR. HADDOCK: I find that with the annular technology, I am able to detect subtle retinal pathology. That is relevant for me when I'm looking for a small retinal tear in a patient with a retinal detachment where the tear is not identified during the exam, or when we're measuring choroidal tumors where the high-resolution images allow us to delineate the lesions better in order to have more repeatable measurements that determine if the lesion is stable or growing.

DR. FISHER: I was impressed by the fact that you could see the sclera, often the choroid, and the retina all in one image.

ULTRASOUND TECHNOLOGY & ONCOLOGY CASES

The advanced, high-resolution ultrasound of the ABSolu™ platform can be particularly useful in diagnosing, monitoring, and treating ocular oncology cases, explains Dr. Fisher. For the most part, physicians are using ultrasound to watch for irregularities of the ocular wall.

"You're looking for either something that would impinge upon the vitreous cavity, or upon the orbital fat, or the optic nerve," he notes. "The better your resolution and the better your sonic penetration, the more you're going to see. Annular technology is very helpful for that particular purpose, because you can move the focus of the beam to the area of interest."

If an abnormal structure is found, it can be carefully delineated by moving the beam focus to that area.

"There is measurement software already available on the device. These software packages measure screen pixels, and while they read out in hundredths of a millimeter, I do not go beyond the resolution capability of the frequency I am utilizing. Repeatability is the key and that takes an experienced examiner," he notes. "Patterns of examination differ. I usually try to have the same examiner perform critical measurements for the same patient over time."

Obtaining repeatable values or close to repeatable values is critical in oncological examination.

"Obviously, the better the image, the better the outline, the better your measurements," Dr. Fisher points out.

"That's why it's going to be extremely helpful for oncologists," he adds. "They will use a series of techniques. Some will use standardized A scan, many people choose to use both A scan and B scan. I choose to use mostly B scan because I'm familiar with it, I feel secure with it, and it shows me where my simultaneous A scan is actually located (Figure 3). But I certainly recognize that people who are skilled in standardized A scan alone are capable of doing the same type of work and obtaining repeatable measurements."

Dr. Fisher continues: "In cases of endophthalmitis, I have personally found that the use of ultrasound prior to the extraction of vitreous fluid (tap) and inject procedures is very helpful in delineating the safest places to do the procedure. Avoiding an area of nonmobile fibrin/clots and/or heavy accumulations of thick material, choroidal or retinal detachment is very helpful in avoiding the so-called 'dry taps,' which are frustrating for the patient and physician, requiring additional attempts to obtain specimens. A quick ultrasound examination prior to such procedures helps avoid most of these challenges."

CASE STUDY: ENDOPHTHALMITIS COMPLICATED BY RETINAL DETACHMENT

DR. HADDOCK: This patient presented with history of endophthalmitis. At my evaluation, this was a case of sub-acute endophthalmitis with prior history of tap and inject. However, I wanted to evaluate the posterior segment to determine if there were signs of active infection or retinal detachment, given that there was no view of the fundus on exam.

I did a standard B15 ultrasound, which showed a large amount of debris in the vitreous cavity. With standard ultrasound, it can be very difficult to determine if the debris is old or new. I repeated the scan using the B20 probe (on the ABSolu™), and it delineated the extent of that debris and showed that the area between the debris and the retina was pretty clear of opacities and likely showing inactive infection (Figure 2a).

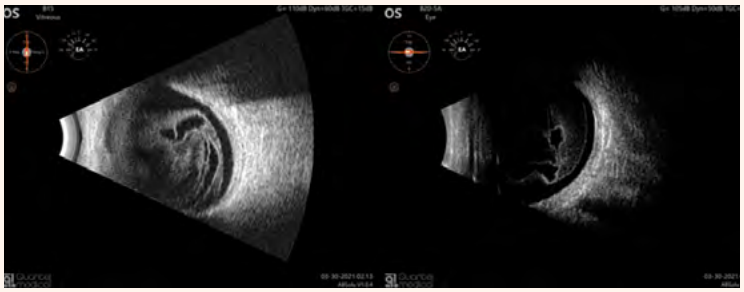


IMAGE COURTESY: LUIS J. HADDOCK, MD

Figure 2a. A B15 (left image) and B20 scan (right image) of vitreous debris.

DR. FISHER: The clear area is quite clear, and most of the cellular material that's producing reflectivity is in the formed vitreous, which takes much, much longer to clear. You're right—this patient had an injection and this helped you to determine whether or not there was progression or resolution. This is really important.

DR. HADDOCK: Unfortunately, this patient returned for a visit a few months later with a change in his vision. Figure 2b shows side-by-side images of the same scanned areas using the B15 and the B20 probes. The high-resolution scan on the right side highlighted and delineated the pathology better. It shows the retinal detachment and its attachment at the optic nerve, the extent of the choroidals, and the location of the preretinal scar tissue.

DR. FISHER: The initial steps of the surgical intervention for this patient will require making incisions and placing cannulas, and you need to know what you're getting into, and know where you can safely do that. Having these kinds of images really changes the way you approach an eye, especially if you can't see into it.

DR. HADDOCK: It highlights the details that can be achieved with either probe, but with the annular B20, higher definition of the tissue is noted. You can see the details of what's happening, how that retina is detached, and how there are choroidals in the front part of the eye.

DR. FISHER: You can certainly see the difference in the quality of the image. And that quality is really critical if you're going to make decisions about how you are going to approach this case surgically.

DR. HADDOCK: With the B15 probe, I could not readily identify the location of the retinal tear that caused this detachment, but noted an area of thickening superonasally. Scanning the same area with the B20, I could see that the membranes had grown on the surface of the retina and had pulled the retina up, likely causing a retinal break. The ultrasound was completed prior to examination; the subsequent exam confirmed growth of large epiretinal membrane superonasal at the area of prior infection that had grown over time and likely caused the retinal detachment. Figure 2b shows the ultrasound image of the scanned area with the membranes correlated with the fundus image; the scan beautifully shows the detail of the probe in identifying these membranes. During surgery, it was confirmed that the scar tissue had grown over an area of prior retinal infection and the traction over the necrotic retina had led to the retinal detachment.

IMAGE COURTESY: LUIS J. HADDOCK, MD

Figure 2b. Longitudinal scan L10 of the left eye using the 15 MHz probe and the 20 MHz annular probe on the ABSolu™ showing choroidal detachment, large retinal detachment, and large preretinal and subretinal membrane in the posterior pole. The widefield color fundus photograph highlights the retina and choroidal detachment and the area of PVR noted in the B scan in the 10 o'clock meridian.

DR. HADDOCK: For patients who have conditions with a thickened choroid, the high-resolution images actually allow us to see the thickening and give us the ability to measure it.

DR. FISHER: If you set either the B15 probe for orbit or the B20 annular for retina, you will notice—if you're holding your hands still—there will be a lot more movement in the orbital fat. You have to get used to this because we are not used to seeing vascular motion induced by the normal arterial pulse pressure. Often, with care, you can trace many of the orbital arterial branches. Quite interesting!

I agree with you regarding oncology—masses and tumors are extremely well-delineated with this device. As far an imaging clear vitreous gel status, these new instruments with advanced imaging capability are really helpful. Detection of vitreous gel separation or persistent adherence is far easier than with earlier instrument versions. Most users adapt quickly and appreciate the ease of interpretation. I often record how far the vitreous gel has separated in each quadrant of the globe.

CONCLUSION

DR. FISHER: I can tell you that having watched all the changes in technology, we're still making major strides in ultrasound. Adding annular technology improves the capability and ease of interpretation to that of a single element device. The ABSolu™ provides an excellent image, and I suspect that this is not the last update. It will continue evolve. I'm proud to be associated with most of the people in the field of ultrasound. I've enjoyed watching it grow. These new devices give you the privilege of feeling more secure about interpretation.

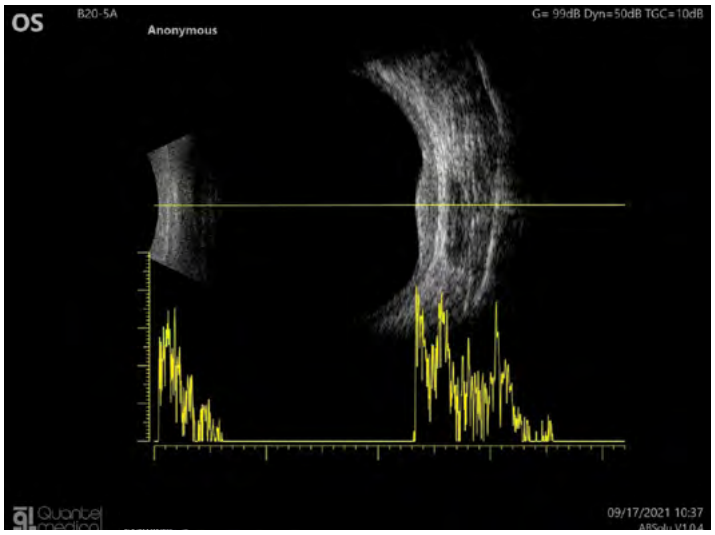


Figure 3. Simultaneous scanning with 20 MHz annular probe and A scan of choroidal melanoma.

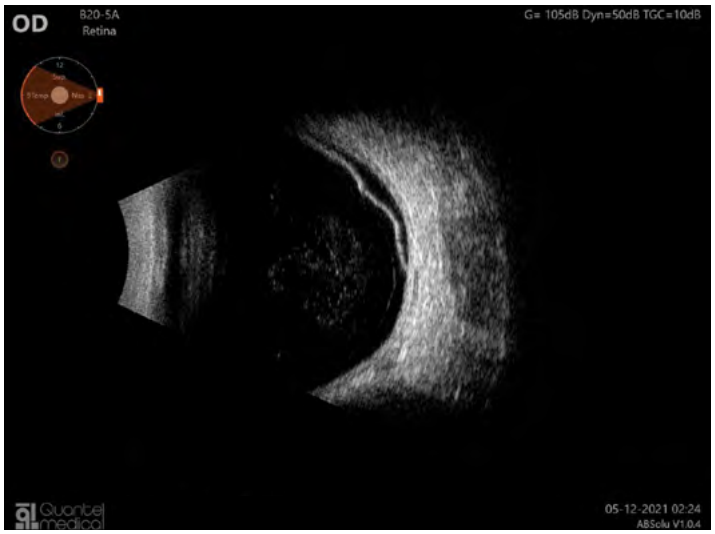


IMAGE COURTESY: LUIS J. HADDOCK, MD

Figure 4. A temporal transverse T9 scan of the right eye using the 20 MHz annular probe on the ABSolu™, showing vitreous traction on a retinal tear with associated retinal detachment.

CASE STUDY: COMMON EXAM USES

High-tech ultrasound devices, such as the ABSolu™, can even be useful for more common retinal conditions, notes Dr. Fisher.

"On occasion, you will find patients with asteroid hyalosis that fills the vitreous cavity so much so that when you try to look inside the eye, you cannot. These little calcium soaps are stuck inside the eye, and while the patient can usually see around them, you, as the physician, have a great deal of difficulty seeing in to evaluate the retina.

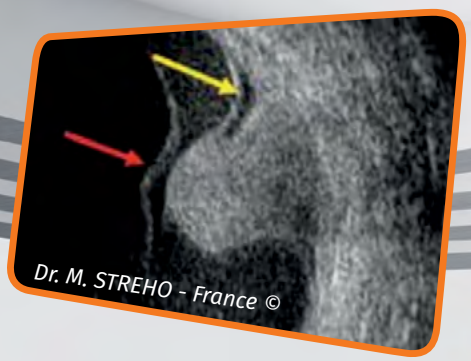
"Using an ultrasound probe, such as that offered by the ABSolu™, enables the physician to delineate what's going on in the retina without the reflections that affect visibility when using an indirect ophthalmoscope.

"Even on a simple case, where you're having difficulty seeing the fundus because of vitreous hemorrhage, or on a pupil that doesn't dilate well, it's helpful to be able to pick up a probe and be certain that the retina is attached and that nothing else is going on inside that eye. A retinal tear can be easily identified (Figure 4).

"While one cannot detect hemorrhage on the surface of the retina because it's within the retina itself, it's nice to know that you can combine your ultrasound with a widefield photograph and be pretty certain—without dilation—that there is no abnormal pathology. That's why I think that ultrasound, if it's used frequently, can serve as an adjunct to your normal fundus exam," Dr. Fisher concludes.

ABSolu™

IMAGING
EXCELLENCE



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